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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/535,050

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David Harbec

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EXAMINER

BARCENA, CARLOS

ART UNIT

PAPER NUMBER

4181

MAIL DATE

DELIVERY MODE

10/28/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/535,050	Applicant(s) HARBEC ET AL.	
	Examiner Dr. CARLOS BARCENA	Art Unit 4181	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 May 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 15-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 and 19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 5/13/2005 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>(1) 05 September 2006; (1) 30 March 2006</u> . | 6) <input type="checkbox"/> Other: _____ |

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :(1) 05 September 2006; (1) 30 March 2006.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed 03/30/2006 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because a copy of reference 1(Boulous *et al.*) has not been provided. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609.05(a).

Election of Species

2. This application contains claims directed to more than one species of the generic invention. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1.

The species are as follows:

- (i) catalyst generated from **droplets of metal generated from a metal sample**
- (ii) catalyst generated from **metal vapor from metal evaporator**
- (iii) catalyst generated from **metal vapor from nanoparticle generator**
- (iv) catalyst generated from **nanoparticles of catalyst added to a liquid carbon precursor**

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Applicant is required, in reply to this action, to elect a single species to which the claims shall be restricted if no generic claim is finally held to be allowable. The reply must also identify the claims readable on the elected species, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered non-responsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

3. The following claim is generic: 1.

4. The species listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical feature since each species has clearly different design and structure.

5. During a telephone conversation with DaLesia Boyd on September 17, 2008 at 1:15 pm, a provisional election was made with traverse to prosecute the invention of the catalyst generated from droplets of metal generated from a metal sample brought into contact with the flame, claim 14. Affirmation of this election must be made by applicant in replying to this Office action. Claims 15-18 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

6. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the

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currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

7. The examiner has required restriction between product and process claims. Where applicant elects claims directed to the product, and the product claims are subsequently found allowable, withdrawn process claims that depend from or otherwise require all the limitations of the allowable product claim will be considered for rejoinder. All claims directed to a nonelected process invention must require all the limitations of an allowable product claim for that process invention to be rejoined.

In the event of rejoinder, the requirement for restriction between the product claims and the rejoined process claims will be withdrawn, and the rejoined process claims will be fully examined for patentability in accordance with 37 CFR 1.104. Thus, to be allowable, the rejoined claims must meet all criteria for patentability including the requirements of 35 U.S.C. 101, 102, 103 and 112. Until all claims to the elected product are found allowable, an otherwise proper restriction requirement between product claims and process claims may be maintained.

Withdrawn process claims that are not commensurate in scope with an allowable product claim will not be rejoined. See MPEP § 821.04(b). Additionally, in order to retain the right to rejoinder in accordance with the above policy, applicant is advised that the process claims should be amended during prosecution to require the limitations of the product claims. **Failure to do so may result in a loss of the right to rejoinder.** Further, note that the prohibition against double patenting rejections of 35 U.S.C. 121 does not apply where the restriction requirement is withdrawn by the examiner before the patent issues. See MPEP § 804.01.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

9. **Claims 1-3 are rejected under 35 U.S.C. 102(a) as being anticipated by Smiljanic *et al.* (*Chem. Phys. Lett.*, 356, 2002, 189-193).**

Claims 1-3 are rejected as anticipated by Smiljanic *et al.* (*Chemical Physics Letters*)

Smiljanic et al teach a method for producing single wall carbon nanotubes (SWNT) based on a gaseous mixture (composed of argon, ferrocene, and ethylene) in an atmospheric plasma jet (see abstract). The carbon nanostructures made were SWNT produced in a plasma. The “carbon-containing gas” is ethylene. The ferrocene serves as the iron source for *in situ* metal catalyst particles. Figure 1 (page 190) illustrates this process of making the SWNT with the carbon-containing gas ethylene injected together with the carrier gas argon and subsequent SWNT collected on a metallic plate. Therefore, every limitation recited by the applicant is disclosed by Smiljanic and claims 1-3 are rejected.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

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having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

13. **Claims 4-7 and 11-12 are rejected under U.S.C. 103(a) as being unpatentable over Smiljanic *et al.* (*Chem. Phys. Lett.*, 356, 2002, 189-193) in view of Tsantrizos *et al.* (US Patent No. 5,395,496), hereafter Tsantrizos #1.**

Smiljanic discloses the production of SWNT from a carbon-containing source (ethylene) with argon as the carrier gas and *in situ* production of metal catalyst (from ferrocene) in an atmospheric plasma jet (abstract, also see 102 rejection above).

Regarding applicant claim 4-6, Smiljanic teaches the use of an atmospheric plasma jet for the production of SWNT.

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Smiljanic does not explicitly teach using a high enthalpy plasma torch with nozzle to produce the plasma used in the carbon nanotubes (CNT) production.

However, in a similar process to Smiljanic, Tsantrizos #1 teaches the synthesis of fullerenes (CNT) in using a high enthalpy non-transferred d.c. plasma torch or an induction plasma torch as the plasma generating device (abstract).

It would have been obvious to one of ordinary skill in the art at the time of invention to substitute a "high enthalpy non-transferred d.c. plasma torch or an induction plasma torch as the plasma generating device" (see abstract) for the production of fullerenes as taught by Tsantrizos #1 for Smiljanic's atmospheric plasma jet. The motivation to do so would have been that both devices generate a plasma and operate at comparable temperatures (Smiljanic, p. 190, col. 2; Tsantrizos #1, col. 3, lines 4-21).

Fullerenes defined by Tsantrizos #1 are "hollow molecules made up of curled-up graphitic sheets" (column 1, lines 22-25) or simply CNT, exactly as claimed in claims 4 and 5. For claim 6, Tsantrizos #1 teaches that "the inert plasma forming gas is preferably helium and the carbon and halogen containing gas is preferably a carbon halide gas such as CBrF_3 or C_2Cl_4 ..." (column 4, lines 41-44), where the tetrachloroethylene is the carbon-containing gas.

Regarding applicant claims 7, Smiljanic fails to teach that the metal electrode generates the metal vapor in the plasma torch. However, since the same type of plasma is used as Tsantrizos #1, it would be obvious to one of ordinary skill in the art that metal vapor or particles would also be ejected from such an electrode in the same type of plasma torch due to the high temperatures produced by the torch even though not expressly said.

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Regarding applicant claim 11, as described in the experimental section of Smiljanic (page 190, col. 2), the carbon-containing gas and catalyst are introduced together and each controlled independently. The ferrocene vapor is obtained by a temperature-controlled sublimation and the carbon-containing gas controlled separately within the specified flow ranges.

Regarding applicant claim 12, described in the examples 1-4 provided by Tsantrizos #1, the operating conditions of the torch including the operating voltage would determine the metal vapor content. The plasma gas composition and gas flow rates are also provided.

14. Claims 8-10 and 19 are rejected under U.S.C. 103(a) as being unpatentable over Smiljanic *et al.* (*Chem. Phys. Lett.*, 356, 2002, 189-193) in view of Tsantrizos *et al.* (US Patent No. 5,395,496) as applied to claims 4-7 and 11-12 above and further in view of Tsantrizos *et al.* (US Patent No. 5,147,998), Tsantrizos #2.

Regarding applicant claims 8-10 and 19, neither Smiljanic nor Tsantrizos #1 teach the specific materials of construction for the electrode. However, the same type of plasma used by Tsantrizos #1 is described in detail by Tsantrizos #2. Tsantrizos #2 states the main feature of their invention is the copper electrodes attached by high temperature soldering, this making it possible to use a much wider range of electrode materials including thoriated tungsten (column 3, lines 44-50). Claim 19 is described by Tsantrizos #2 on column 2, lines 42-52. The refractory electrode material could be a ceramic. The water-cooling system is also described therein.

15. Claim 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smiljanic *et al.* (*Chem. Phys. Lett.*, 356, 2002, 189-193) in view of Cohen *et al.* (US Patent No. 5,993,697).

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As stated above, Smiljanic teaches making SWNT in a plasma torch with a carbon-containing gas and with catalysts formed *in situ* disclosing what is recited in applicant's claim 1. Smiljanic does not teach injecting at least one metal powder into the outlet flame of the torch. Cohen teaches making metallic carbon materials or CNT in a plasma where catalytic particles, such as transition metals, in powder or other form can be injected directly into the arc or with the carbon feedstock (column 14, lines 12-15). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that a catalyst is needed to grow nanostructures regardless of whether the catalyst was added together with the carbon-containing gas (as the case with Smiljanic) or after in the flame in a variety of forms as long as both the carbon source and catalyst are present together. Introducing the metal catalyst directly into the plasma is useful to produce metallic carbon nanostructures (Cohen abstract).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. CARLOS BARCENA whose telephone number is (571) 270-5780. The examiner can normally be reached on Monday through Thursday 8AM - 5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on (571) 272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C.B./

/Vickie Kim/

Supervisory Patent Examiner, Art Unit 4181